

## PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY  
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference OP100940/JUM	<b>FOR FURTHER ACTION</b> See Form PCT/IPEA/416	
International application No. PCT/FI2005/000086	International filing date (day/month/year) 10-02-2005	Priority date (day/month/year) 12-02-2004
International Patent Classification (IPC) or national classification and IPC See Supplemental Box		
Applicant NEWTEST OY et al		

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 7 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
  - ☒ (sent to the applicant and to the International Bureau) a total of 5 sheets, as follows:
    - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
    - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
  - ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) \_\_\_\_\_, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

- This report contains indications relating to the following items:

- |                                     |              |   |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I    | Basis of the report   |
| <input checked="" type="checkbox"/> | Box No. II   | Priority  |
| <input type="checkbox"/>            | Box No. III  | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  |
| <input type="checkbox"/>            | Box No. IV   | Lack of unity of invention  |
| <input checked="" type="checkbox"/> | Box No. V    | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input checked="" type="checkbox"/> | Box No. VI   | Certain documents cited   |
| <input type="checkbox"/>            | Box No. VII  | Certain defects in the international application  |
| <input type="checkbox"/>            | Box No. VIII | Certain observations on the international application   |

Date of submission of the demand  24-11-2005	Date of completion of this report  09-02-2006
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 Form PCT/IPEA/409 (cover sheet) (April 2005)	Authorized officer  Gordana Ninkovic/MP Telephone No. +46 8 782 25 00

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International application No.

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**Supplemental Box**

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Cover sheet

**INTERNATIONAL PATENT CLASSIFICATION (IPC) :**

**A61B 5/11** (2006.01)

**G01S 11/14** (2006.01)

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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## Box No. I Basis of the report

## 1. With regard to the language, this report is based on:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into \_\_\_\_\_,  
which is the language of a translation furnished for the purposes of:
- ☐ international search (Rules 12.3(a) and 23.1(b))
- ☐ publication of the international application (Rule 12.4(a))
- ☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

- ☐ the international application as originally filed/furnished
- ☒ the description:  
pages 1-13 \_\_\_\_\_ as originally filed/furnished  
pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_  
pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the claims:  
pages \_\_\_\_\_ as originally filed/furnished  
pages\* \_\_\_\_\_ as amended (together with any statement) under Article 19  
pages\* 16-20 received by this Authority on 24-11-2005  
pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☒ the drawings:  
pages 1-3 \_\_\_\_\_ as originally filed/furnished  
pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_  
pages\* \_\_\_\_\_ received by this Authority on \_\_\_\_\_
- ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/figs \_\_\_\_\_
- ☐ the sequence listing (*specify*): \_\_\_\_\_
- ☐ any table(s) related to the sequence listing (*specify*): \_\_\_\_\_

\* If item 4 applies, some or all of those sheets may be marked "superseded."

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**Box No. II**      **Priority**

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:
- ☐ copy of the earlier application whose priority has been claimed (Rule 66.7(a)).
- ☐ translation of the earlier application whose priority has been claimed (Rule 66.7(b)).
2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rule 64.1). Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

Priority is considered to be valid, so document US 20040113805 (P,A) is of no relevance.

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**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims	<u>1-22</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-22</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-22</u>	YES
	Claims		NO

## 2. Citations and explanations (Rule 70.7)

## Cited documents:

- D1. US 5831937 A (WEIR,R.F. ET AL), 3 November 1998  
D2. US 5583776 A (LEVI,R.W. ET AL), 10 December 1996  
D3. US 20020107649 A1 (TAKIGUCHI,K. ET AL), 8 August 2002  
D4. WO 03055389 A1 (NEWTEST OY), 10 July 2003  
D5. US 20040113805 A1 (FARDIN,R. ET AL), 17 June 2004

In a view of new claims amended at 24-11-2005, documents D1 and D2 are reconsidered to represent the state of the art, together with documents D3-D5.

The invention concerns a method and arrangement for measuring the length of steps and solves the problems related to prior art methods, e.g. accuracy and rigidity.

The aim/object of the invention is to provide a method and a device arrangement, by which the step length of a person can be measured without manual measurements, calculations and saving of data by a simple device arrangement.

Document D1 describes a portable ranging system for analyzing gait, comprising a transponder having an infrared receiver and an ultrasound emitter, a base unit having an infrared emitter and an ultrasound receiver, and a computer terminal. Upon actuation, the circuitry begins counting (i.e. the moment of transmission) and simultaneously causes the infrared emitter to emit infrared light into a ranging area. The infrared receiver receives the infrared light, and in response, emits an ultrasound pulse.

.../...

## Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V

The ultrasound pulse is then received by the ultrasound receiver, which in turn causes the system circuitry to stop counting (i.e. the time of reception). The circuitry then can use the count data to calculate the time of movement of the ultrasound pulse and thus the distance between the ultrasound emitter and the ultrasound receiver, see column 3, lines 12 to 37. Furthermore, the circuitry computes a plurality of gait parameters for the walking subject, e.g. velocity and acceleration. The number of steps and the step length can then be determined using the zero crossing in the instantaneous acceleration array, see figure 13 and column 10, line 60 to column 11, line 35.

Document D2 describes a navigational system using an accelerometer to provide acceleration data indicative of footsteps, see column 3, lines 12-36.

However, none of the cited documents discloses a method, an arrangement and devices for measuring the length of steps by means of synchronized delayed sound frequency pulses where the synchronization is done only once in the measuring time.

In view of the cited documents such a method, an arrangement, a receiver and a transmitter cannot be considered obvious to a person skilled in the art.

Therefore the invention claimed in claims 1 - 22 is novel and considered to involve an inventive step.

The invention is regarded to be industrially applicable.

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

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**Box No. VI** Certain documents cited

## 1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
US 20040113805 A1	17.06.2004	19.11.2003	06.12.2002

## 2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)
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**Claims**

1. A method for measuring the length of a person's (1) steps, in which method the distance covered (S) and the number of steps (N) used is measured, **characterized** in that in the method
- 5 – the distance covered (S) is measured by transit time measurement of sound frequency pulses (12a, 12b, 12c), which are transmitted using a delay ( $\tau$ ) between the pulses;
- 10 – the transit time of each sound pulse is measured between the moving person (1, B) and a fixed point (A); and where
- before measuring the distance covered
- a measuring time (M) (300) used for measuring the length of steps is determined and
- 15 – clocks of a transmission means (11) and a reception means (10) of the sound pulses are synchronized before the transmission of a first sound pulse for the overall measuring time (M), whereby the reception means (10) of the sound pulses know both the moments of reception of the sound pulses (12a, 12b, 12c) and the moment of transmission (300) of each sound pulse (12a, 12b, 12c) and that
- 20 – number of steps (N) taken during the measurement are measured by an acceleration transducer (48) carried along by the person.
2. The method according to Claim 1, **characterized** in that the means used for transmitting the sound pulses (12a, 12b, 12c) is a sound transmitter (11), which
- 25 transmits sound pulses essentially in the frequency range of 1 000–2 000 Hz and that the means used for receiving the sound pulses is a sound receiver (10), which can receive and indicate a sound pulse transmitted in the frequency range used.
3. The method according to Claim 2, **characterized** in that the moving person
- 30 (1) has the sound transmitter (11), which transmits (311–314) sound frequency pulses (12a, 12b, 12c), which are received (320–322) by the sound receiver (10) at a fixed point (A).
4. The method according to Claim 3, **characterized** in that the distance estimate (S) obtained by the transit time measurement of the sound pulse (12a, 12b, 12c) is corrected (321) by at least one of the following factors having an effect on
- 35 the transit time of the sound pulse (12a, 12b, 12c): the height (H) of the sound



transmitter, (the angle  $\alpha$ ), the temperature of the air, the direction of the wind (angle  $\beta$ ) or the speed of the wind.

5     5.     The method according to Claim 3, **characterized** in that after the measuring period, the sound transmitter (11) sends an ending pulse (330) of the step length measurement, which ending pulse is received (340) in the sound receiver (10) and in which the final distance (S) of the person (1) from the sound receiver (10) is calculated.

10     6.     The method according to Claim 1, **characterized** in that the step length is calculated by dividing the measured final distance (S) by the number of steps (N) measured by the acceleration transducer (48).

15     7.     The method according to Claim 6, **characterized** in that the number of steps (N) measured is transferred from the sound transmitter (11) to the sound receiver (10) through a wireless electric link.

20     8.     A measuring arrangement for measuring the length of a person's (1) steps, which arrangement comprises means for measuring the distance covered (S) and number of steps (N) used, **characterized** in that in the measuring arrangement  
– the distance covered (S) is arranged to be measured by transit time measurement of sound frequency pulses (12a, 12b, 12c), which are transmitted using a delay ( $\tau$ ) between the pulses;  
– the transit time of each sound pulse is arranged to be measured between a moving person (1, B) and a fixed point (A) and where  
25     – before measuring the distance covered;  
         – a measuring time (M) (300) to be used has been determined and  
         – clocks of a transmission means (11) and a reception means (10) of the sound pulses have been synchronized before the transmission of a first  
30     sound pulse for the overall measuring time (M), whereby the reception means (10) of the sound pulses have knowledge of both the moments of reception of the sound pulses (12a, 12b, 12c) and the moments of transmission (300) of each sound pulse (12a, 12b, 12c), and that  
         – number of steps (N) taken during the measurement of the length of steps is arranged to be calculated from acceleration pulses caused by the steps, measured  
35     by an acceleration transducer (48) carried along by the person.

9. The measuring arrangement according to Claim 8, **characterized** in that the means for transmitting the sound pulses (12a, 12b, 12c) comprise a sound transmitter (11), which is arranged to transmit sound pulses essentially in the frequency range of 1 000–2 000 Hz and that the means for receiving the sound pulses comprise a sound receiver (10), which can both receive and indicate a sound pulse transmitted in the frequency range used.

10. The measuring arrangement according to Claim 9, **characterized** in that the moving person (1) has the sound transmitter (11), which is arranged to transmit (311–314) sound frequency pulses (12a, 12b, 12c), which are arranged to be received (320–322) by the sound receiver (10) at a fixed point (A).

11. The measuring arrangement according to Claim 10, **characterized** in that a distance estimate (S) obtained by the transit time measurement of the sound pulse (12a, 12b, 12c) is arranged to be corrected (321) by at least one of the following factors having an effect on the transit time of the sound pulse (12a, 12b, 12c): the height (H) of the sound transmitter, (the angle  $\alpha$ ), the temperature of the air, the direction of the wind (angle  $\beta$ ) or the speed of the wind.

12. The measuring arrangement according to Claim 10, **characterized** in that the step length measurement is arranged to be stopped by a stopping pulse (330) sent by the sound transmitter (11).

13. The measuring arrangement according to Claim 12, **characterized** in that after the reception of the stopping pulse (340), the sound receiver (10) is arranged to calculate the final distance (S) of the person (1) from the sound receiver (10).

14. The measuring arrangement according to Claim 8, **characterized** in that the step length is arranged to be calculated by dividing the measured final distance (S) by the number of steps (N) measured by the acceleration transducer (48).

15. The measuring arrangement according to Claim 14, **characterized** in that the number of steps (N) measured is arranged to be transferred from the sound transmitter (11) to the sound receiver (10) through a wireless electric link.

16. A sound receiver (10), **characterized** in that it comprises
- a central processing unit (CPU);
  - a memory;
  - a clock function (41) for calculating the transit time of a received sound pulse
- 5 and for performing the calculation of the distance (S) on the basis of that;
- a means for synchronizing the clock function (41) before a first received sound pulse for the overall measuring time (M);
  - a user interface (43) for inputting the initial information of the step length measurement and for presenting the measurement result of the calculated length of
- 10 steps;
- a sound frequency receiver (42) for receiving and indicating a sound signal of essentially the frequency of 1,000–2,000 Hz and
  - a power source (44).
- 15 17. The sound receiver (10) according to Claim 16, **characterized** in that the input of the initial information of the step length measurement, the determination of the transit time of the sound pulse and the determination of the length of steps on the basis of that and presenting the measurement result have been implemented by a program application saved in the sound pulse reception means (10).
- 20 18. The sound receiver (10) according to Claim 17, **characterized** in that it is part of a terminal of a cellular network.
19. A sound transmitter (11), **characterized** in that it comprises
- 25 – a central processing unit (CPU);
- a memory;
  - a clock function (45)
    - for transmitting a sound pulse used in the measurement at the intervals of a certain delay ( $\tau$ );
- 30 – for detecting the end of the time (M) defined for the measurement;
- for sending a measurement ending pulse;
- a means for synchronizing the clock function (45) before transmitting a first sound pulse for the overall measuring time (M);
  - a user interface (47) for starting the step length measurement;
- 35 – a sound frequency transmitter (46) for transmitting a sound signal of essentially the frequency of 1,000–2,000 Hz;

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- a means (48) for detecting an acceleration peak caused by a step and for saving the number (N) of the acceleration peaks detected and
- a power source (44).

5     20. The sound transmitter (11) according to Claim 19, **characterized** in that the delay ( $\tau$ ) used in the transmission of the sound pulse, the length (M) of the step length measurement time and the determination of the transmission moment of the ending pulse have been implemented by a program application saved in the sound transmitter (10).

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21. The sound transmitter (11) according to Claim 19, **characterized** in that it also comprises a means for transferring the number (N) of the acceleration peaks by a wireless data transfer link to another device (10).

15     22. The sound transmitter (11) according to Claim 19, **characterized** in that it is part of a terminal of a cellular network.